SOME EXPERIENCES IN APPLYING AUDIBLE SIGNALS FOR THE BLIND AT INTERSECTIONS IN THE CITY OF ZAGREB

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SUMMARY

Traffic control at intersections equipped with special audible signaling for the blind can be performed in different ways. It should be stressed that efficient control depends on a series of design elements. The intersection has to be specially designed, optimum crossing places for the blind have to be considered and optimum audible signaling has to be applied. It is sometimes desirable to add tactile information as well. Experiences acquired by installing audible signaling at several intersections in the city of Zagreb have been used as a kind of recommendation that needs to be taken into consideration in designing similar facilities.

INTRODUCTION

How many times have we wondered how to behave in the presence of visually impaired people? Unfortunately, mainly too late, that is, when we already find ourselves in such a situation. In any case, it is worth remembering that the attitude towards the blind in such situations is important in order to establish the correct and spontaneous relationship. Avoiding such words as "look", "blind", etc. will only emphasis the awareness of the blind persons of their position. Naturally, we should announce our presence in the company of a blind person as well as the fact that we are leaving.

Apart from a series of other personal questions requiring an answer, the question asked most by the experts on traffic regulation technology refers to the way in which a blind person is to be informed about the traffic. They should be made aware of the traffic and of the dangers to which they are subjected. Offering a hand to a blind person when crossing the street is most certainly a very humane gesture, but to make it possible for blind persons to find their way through traffic in an independent way is a far greater achievement.

There is a series of electronic aids today, ranging from the simplest ones which inform about the red or green phases on the traffic lights, to those more complex "information systems" which inform blind persons about movement not only in traffic but everywhere in space.

This paper aims to give incentive to consideration about some relevant facts which need to be taken into account in tending towards achieving optimal traffic, and electrical and technical solutions for guiding the blind when crossing the street at intersections.

INTERSECTION DESIGN

In designing an intersection the optimal paths for the blind need to be analyzed. These should no be too long nor divided into segments. Thus, it needs to be considered whether to design an intersection as in example A or B or C (Figures 2, 3 and 4). The paths should be simple, both because of the simplest possible movement free of barriers, and because of the location of audible signaling devices that announce free crossing.

In Example A, the intersection has been well designed but it has too many conflicting traffic flows, and a great number of posts where audible signaling devices would have to be located and this may have a confusing effect. For example, for traffic participants to cross from post V – IV – VI – VII – VIII – X – IX, they have to stop four times and orientate themselves according to the source of the audible signal, at the same time pressing the push-button to request the clearance to cross, if traffic-dependent regulation principle has been applied.

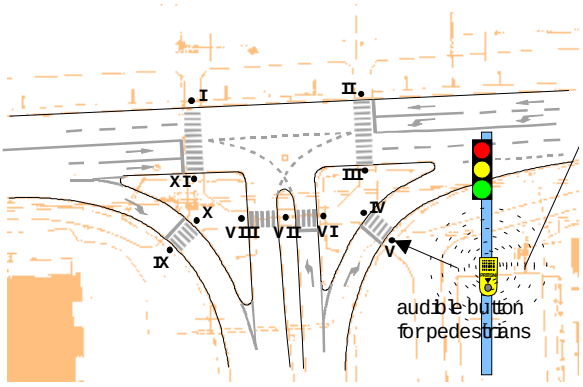

Figure 2 - Example A

Example B presents a simplification of the announcement and movement principle since the central island with post VII has been eliminated. The pedestrians do not have to stop on the central island, which may represent potential risk of car-pedestrian collision. In order to pass from post V to post IX, they have to stop and orientate themselves three (3) times.

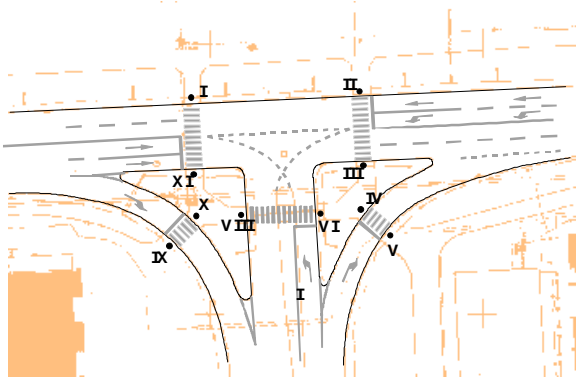

Figure 3 - Example B

Example C simplifies even further the principle of announcement and movement of the blind, with all protective islands at intersection approaches eliminated. Only the posts with audible signaling devices and push-buttons remain at crossings I - XI, II – III and VI – VIII. In a sense, this example represents a good solution for the blind, but this is to the great disadvantage of other parameters relevant for other traffic participants. The "discharging" routes of conflicting surfaces have been increased, the distribution of signaling groups has resulted in more conflicts, the visibility of signals has been reduced, etc. Example C is a doubtful solution for the blind persons because of the excessively long pedestrian crossing, which may create a feeling of uneasiness.

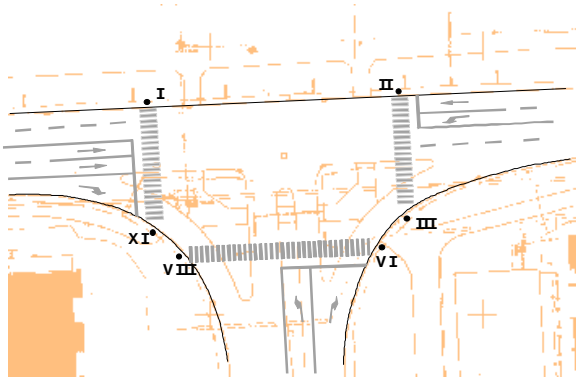

Figure 4 - Example C

PEDESTRIAN FLOW MANAGEMENT

When we consider an intersection where a blind person should cross the street, it is not necessary to equip all the pedestrian crossings with audible signals, and if necessary with pedestrian push-buttons as well. As example, we can use the example from the previous intersection where design was analyzed.

Let us look at the pedestrian surfaces X, Y and Z. In order to make it possible for the pedestrian to cross from every pedestrian area into any other, it is sufficient to decide between crossings I – XI or II – III and the obligatory crossing VI – VIII (Fig. 5 example D, Fig. 6 example E). Thus, crossings I – XI and II – III eliminate this mutual necessity. It certainly needs to be checked which crossing is more suitable for blind persons, that is, which are the more frequent routes.

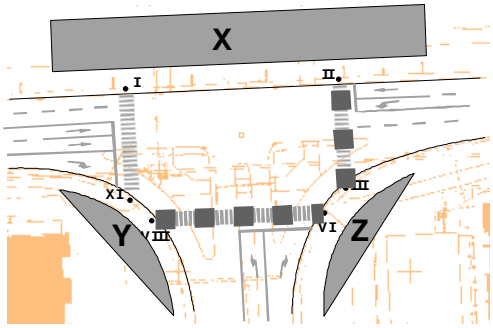

Figure 5 - Example D

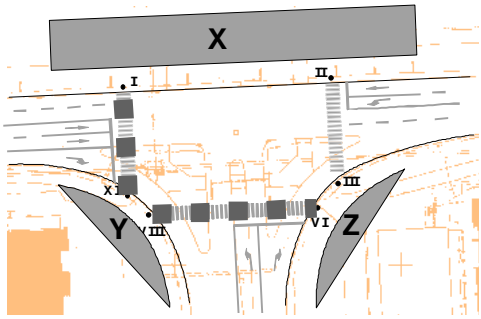

Figure 6 - Example E

PROPOSAL FOR DESIGN AND MANAGEMENT SOLUTION

From the previous two analyses, i.e. design and management of pedestrian flows, a solution can be proposed that may be acceptable also in the conditions of guiding the blind persons at light controlled intersection.

Having in mind that traffic demand should be adjusted for all traffic participants, it would be best to design an intersection in such a way as to eliminate traffic lights for the right turning vehicles and to leave triangular islands, and to provide road crossing with traffic lights and audible signaling devices only at two pedestrian crossings (Fig. 7 - example F).

As additional warning to right turning drivers of the pedestrian crossing ahead, an additional signaling device with flashing amber light and a pedestrian silhouette could be installed.

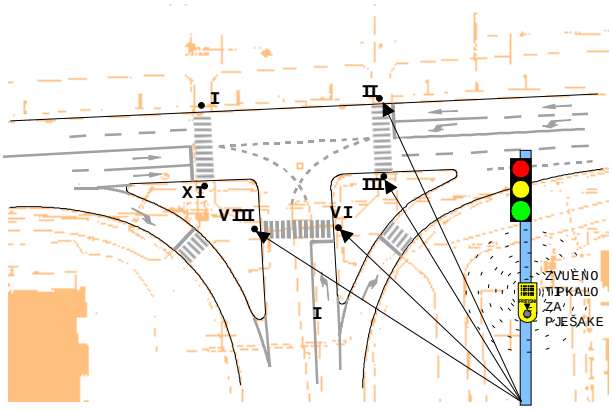

Figure 7 - Example F

DESIGN OF ACOUSTIC SIGNALLING DEVICE

When they first appeared, the audible signaling devices were designed as electromagnet with anchor which tapped on a pad at certain intervals (Ericsson). Slow tapping meant a "don't walk" interval, and fast tapping meant "ped-clearance" interval because the vehicles had been stopped. Such design, adopted to a greater extent in Scandinavia, proved efficient since it made it possible for the pedestrians to feel the arrow by touch because the vibrations caused by the tapping of the anchor represented the tactile information about the possibility and direction of crossing the street.

After that, and even today, signaling devices have been increasingly used in various designs with loudspeakers or piezo-signals.

Ped-clearance audible signal is usually a sinusoid-like tone of 880Hz frequency. The interval frequency is 2Hz with 1:1 switching on-off ratio.

According to recommendations the signal should be of minimum loudness of 30 dB and at least 5 dB above environmental noise. It is customary today to design audible signaling devices with environmental noise sensors and with automatic sound adjustment to the level of ca. 5-10 dB above the environmental noise.

The signaling devices should in principle be located at the centre of the pedestrian crossing directed towards the street centre if mounted at the height of the light signal. In advanced technologies of traffic management it is necessary to install also the pedestrian push buttons

in order to accept requests for crossing, it is customary and most often the signaling devices are used in combination with pedestrian push buttons. In such design the signaling devices with push buttons are installed on posts at the height of 1.1 - 1.2 m.

Since the sound intensity needs to be adjusted both regarding the distance at which it should be identified and the length of the pedestrian crossing, the audibility should reach at least 8m.

One of possible designs is to install two signaling devices at the same location. One with constant source of sound in order to provide orientation and information on the location of the post immediately next to the pedestrian crossing, and the other signaling device in combination with the pedestrian push button. The second signaling device gives two kinds of audible signals, that is, a slow one which means red on the traffic light and fast one meaning that there is green for the pedestrians on the traffic light. Both signaling devices are located on the same post. The signaling device for orientation should be obligatory in traffic-dependent control application.

There are a number of other possibilities in designing the signaling devices, ranging from the simplest ones to those that emit and imitate various sounds of birds and even to voice messages. Of course, there is a limit in all this, to which extent such information is efficient as information and when it may turn into misinformation.

The disadvantage of all audible signaling devices is that they disturb at the same time the residents living in the vicinity. In order to alleviate this problem, it is possible to use time unit to limit the sound to operate during the day only and to be switched off during night, or they may switch to automatic operation, that is, recording the level of environmental noise and adjusting to the necessary recognition level.

One of the efficient measures of applying the signaling devices is to switch on the sound only when request to cross the street is input. Then the sound may last from 2 - 3 minutes and in accordance to the red or green for the pedestrians. After that the signal is switched off and remains in stand-by mode expecting the next push button activation. This method needs to be provided with a sign that it is the push button for the blind only. This would eliminate the dilemma of other pedestrians whether they should press the button or not if they want to cross the street.

CONCLUSION

Audible signaling is efficient information for visually impaired or completely blind persons. In applying audible signals at light controlled intersections, the following should be taken into consideration:

- signaling devices should be located only in agreement with the associations of the blind,
- signaling devices should be set primarily at crossings frequently used by the blind,
- on heavily traveled streets and simply designed intersections, the blind people will have less problems in getting around,
- dangerous streets are those with several lanes and high level of environmental noise,
- dangerous streets are those that allow high speeds,
- it is recommended to avoid management of pedestrian traffic, which is difficult to understand,

- guiding of the blind persons across the street with central islands where the blind should stop, should be avoided,
- unique application of technological and traffic solutions for the whole city and wider.

It has been concluded in the city of Zagreb that audible information at light controlled intersections has its significance for the overall safety system at the intersection as well. All pedestrians at the intersection obtain in this way additional warning about the possibility to cross the street. The advantage is that people do not have to watch the other side of the street where the traffic light is located, but rather get information by ear and can focus more on other participants and their possible errors as well as barriers they encounter while crossing the street.

Finally, in order to view the presented issues and the significance of safety, this is a proposal to carry out detailed research and analysis in other fields, as well as to publish additional directives for designing intersections and the necessary equipment considering all the specific features of the movement of the blind participants in the traffic process.

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